EIGHTH ANNUAL REPORT

OF THE

AGRICULTURAL

Experiment Station

FOR SOUTH DAKOTA,

FOR THE

FISCAL YEAR ENDING JUNE 30, 1895.

AGRICULTURAL COLLEGE, BROOKINGS, S. D.

1896.
HURONITE PRINTING HOUSE,
HURON, S. D.

LETTER OF TRANSMITTAL.

Hon. Charles H. Sheldon, Governor of South Dakota:

SIR,—I have the honor to transmit herewith the eighth annual report of the Agricultural Experiment Station for the fiscal year ended June 30, 1895, in accordance with the requirements of law.

Very respectfully,

LEWIS MCLOUTH,

Pres. of Ag. College and Experiment Station.

Brookings, S. D., December 9, 1895.

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W. H. MURPHY, WILLIAM WEST, } .....Teamsters

UNITED STATES DEPARTMENT OF AGRICULTURE,

OFFICE OF EXPERIMENT STATIONS.

Schedules for Financial Reports of the Agricultural Experiment Stations as Prescribed by the Secretary of Agriculture August 25, 1894.

EXPLANATORY NOTES.

1. The forms for the statement proper include one main schedule, an auditor's certificate, and eighteen abstracts. There is also a form for a supplementary statement, which is requested but not prescribed.

2. The statement proper should include receipts and expenditures under the Act of Congress of March 2, 1887, only, and for the United States fiscal year (ending June 30).

3. The supplementary statement should include receipts and expenditures for all sources of station revenue other than the appropriation under the Act of Congress aforesaid, and when practicable should be for the United States fiscal year. As the main object of this supplementary statement is to assist in the interpretation of the statement proper, it is desirable that it should, as far as practicable, have the same form.

4. The main schedule of expenditures provides for eighteen ledger headings. The object has been to provide a clear and self-explanatory statement of station expendi-

tures, and it has, therefore, been deemed desirable to make the number of headings sufficient to differentiate the principal items which would naturally enter into such an account.

5. The auditors' certificate must be signed by the duly appointed auditors of the corporation which is the legal recipient of the station funds, and must be accompanied by the seal of the institution attested by its proper custodian.

6. Space is provided on the sheets accompanying the main schedule for abstracts under each of the ledger headings. It will be noted, however, that in several cases subdivision and classification of the ledger accounts are deemed unnecessary; in such cases a brief statement is requested regarding the nature of the expenditures under these heads, and the necessity therefor. Careful attention should be paid to the explanatory notes accompanying the several abstracts.

7. It is neither expected nor advised that the current accounts of the station be kept in exact conformity to the accompanying form of report. Local conditions and peculiarities of station work may often require accounts additional to those mentioned in these schedules. But it is advised, for the purpose of simplifying the compilation of the required report or "annual financial statement," that all additional accounts or modifications of those proposed be framed with a view to corresponding with and directly contributing to the form of statement now prescribed in accordance with the Act of Congress. When the annual statement is prepared, it must be of this prescribed form, and upon the blanks furnished by the Department.

It is believed that every fact of expenditure and record which may arise in station work can be easily made to

conform to these blanks. There will, doubtless, be instances of difference of individual opinion on the part of accounting and reporting officers as to the place for assigning certain items, but such differences cannot be wholly prevented and will not materially affect the result. For example, there may be supplies purchased which are to be accounted for on abstract No. 8, and it is difficult to determine whether they are (*a*) Agricultural, (*b*) Horticultural, or (*c*) Botanical; one person may classify these items under (*a*), and another under (*b*) or (*c*) in the abstract, and this will be immaterial. Similarly, there may be doubt in some cases whether an article is an "implement," a "fixture," or a piece of "scientific apparatus." Minor differences arising from such causes will not impair the accuracy and value of the report.

An account may be kept with "Dairy Experiments," for example, but as there is no such heading in the prescribed form, when the report is made up, the items of this account should be distributed among "labor," "supplies," "feeding stuffs," "tools," "live stock," etc. The expenses of "Tobacco Experiments," perhaps at a point distant from the station, might be originally recorded as a separate account, but in the report would be distributed under such headings as "salaries," "labor," "supplies," (agricultural), "fertilizers," "implements," "travel," etc.

8. The expenses of branch stations, (if supported by United States funds) should be merged with those of the main station in the report, and distributed according to the classification prescribed.

9. Changes in the form prescribed, and variations from it in reports rendered, cannot be accepted at the Department. They would involve much additional labor in examination and comparison, and prevent convenient tabulation, which is very desirable.

A. C. TRUE,
Director.

APPROVED:
J. STERLING MORTON,
Secretary.

Agricultural Experiment Station of South Dakota in Account with the United States Appropriation, 1894-5.

DR.			
To Receipts from the Treasurer of the United States as per appropriation for fiscal year ending June 30, 1895, as per Act of Congress approved March 2, 1887			$15,000.00
CR.		*Abstract.*	
By Salaries		1	8,186.50
Labor		2	2,735.46
Publications		3	1,061.12
Postage and stationery		4	308.94
Freight and express		5	266.50
Heat, light and water		6	1.00
Chemical supplies		7	42 09
Seeds, plants, and sundry supplies		8	694.23
Fertilizers		9	.....
Feeding stuffs		10	851.66
Library		11	131.73
Tools, implements, and machinery		12	266.23
Furniture and fixtures		13	.....
Scientific apparatus		14	127.62
Live stock		15	.....
Traveling expenses		16	53.85
Contingent expenses		17	22.00
Building and repairs		18	251.07
Balance			.....
TOTALS			$15,000.00

We, the undersigned, duly appointed auditors of the corporation, do hereby certify that we have examined the books and accounts of the Agricultural Experiment Station of South Dakota for the fiscal year ending June 30, 1895; that we have found the same well kept and classified as above, and that the receipts for the year from the treasurer of the United States are shown to have been $15,000, and the corresponding disbursements $15,000; for all of which proper vouchers are on file and have been by us examined and found correct.

And we further certify that the expenditures have been solely for the purposes set forth in the Act of Congress approved March 2, 1887.

Signed: J. W. SHANNON,
O. T. GRATTAN,
Auditors.

[SEAL]

ATTEST: ED. F. HEWIT,
Custodian of the Seal.

South Dakota Agricultural Experiment Station, 1894-5.

[*The total amount on this and all following abstracts must agree with the amount under the same heading on the first or main sheet of statement.*]

ABSTRACT 1.—SALARIES.

a.	Director and administrative officers	No. 3	Amount	$1,900 00
b.	Scientific staff	No. 7	"	4,606.50
c.	Assistants to scientific staff	No. 6	"	1,680.00
	TOTAL			$8,186.50

NOTES—*a.* Such as secretary, treasurer, accountant, business agent, stenographer, clerk.

c. Intended to represent scientific assistants; but if farm superintendent, foreman or similar employee is regularly elected or engaged by the year, so as to belong on the salary list, the same should be here included.

REMARKS—*a.* Includes President of Station Council, Secretary and Stenographer. They are all officers of the College and receive a large portion of their salary from other funds.

c. Includes foreman of farm, foreman of gardens, teamsters and scientific assistants. The assistants do college work also and are partly paid from college funds.

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 2.—LABOR.

[*If impracticable to report disbursements for labor in accordance with this schedule, make statement in some other form on this sheet, but include number of different persons employed, average rate of wages, and total amount paid for labor.*]

	(All personal services not reported under Salaries, but not including labor on buildings, improvements, or repairs.)		
a.	Monthly employees; No.....; Average rate.....; Amount.....		.....
b.	Daily " No. 8; Average rate $1.50; "		$205.14
c.	Hourly " No.....; Average rate 12½ cents "		2,530.32
	TOTAL		$2,735.46

REMARKS—*c.* Is labor performed by students of the College and it is impracticable to give the number engaged. All monthly employees are included in salary abstract.

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 3.—PUBLICATIONS.

a.	For printing 4 Bulletins—No. of pages 152 (Total edition 40,000)	$604.96
b.	For printing 7th Annual Report—No. of pages 34 (Total edition 1,000)	54.68
c.	For envelopes for bulletins and reports	120.00
d.	Other expenses	281.48
	TOTAL	$1,061.12

NOTE—*a* and *b*. Enter number of different bulletins issued, aggregate number of pages, and total number of copies printed; also number of pages in annual report and total number of copies printed.

REMARKS—*d*. Includes illustrations, press bulletins and blanks.

South Dakota Agricultural Experiment Station, 1894-5.

[*Abstracts 4 and 5 need not be filled out unless explanation of particular items is deemed necessary or desirable.*]

ABSTRACT 4.—POSTAGE AND STATIONERY.

(Not filled out.)

ABSTRACT 5.—FREIGHT AND EXPRESS.

(Not filled out.)

South Dakota Agricultural Experiment Station, 1894-5.

[*Abstract 6 need not be filled out, except so far as explanation of the different items is deemed desirable or necessary.*]

ABSTRACT 6.—HEAT, LIGHT, AND WATER.

a. Heat	.....
b. Light	$1.00
c. Water	.....
TOTAL	$1.00

REMARKS.—The expense under this abstract has been heretofore and was this year almost entirely paid from other funds.

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 7.—CHEMICAL SUPPLIES.

a. Chemicals	$36.44
b. Other supplies	5.65
TOTAL	$42.09

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 8.—SEEDS, PLANTS, AND SUNDRY SUPPLIES.

a.	Agricultural	$266.96
b.	Horticultural	217.52
c.	Botanical	76.68
d.	Entomological	
e.	Miscellaneous	133.07
	TOTAL	$694.23

NOTE—*a.* Such items as nails, small hardware, and blacksmithing may be here included, unless more properly scheduled under Abstract 12—Repairs.

If supplies are purchased for departments not named in above schedule, *e. g.*, veterinary, meteorological, dairy, they should be entered under Miscellaneous, but an explanatory note may be appended stating what is included under this head (*e.*)

NOTE—*e.* Includes Veterinary and Animal Pathology Departments.

South Dakota Agricultural Experiment Station, 1894-5.

[*If subdivision and classification under accounts included in abstracts 9 and 10 is impracticable, make a brief statement as to the nature of and necessity for such expenditures.*]

ABSTRACT 9.—FERTILIZERS.

To include water for irrigation.

(Not filled out.)

ABSTRACT 10.—FEEDING STUFFS.

(Not filled out.)

The large expenditure under this head was caused by the unusual drouth of 1894, necessitating the purchase of feed that would otherise have been grown on College farm and furnished the Station without cost.

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 11.—LIBRARY.

[*Not to be filled out unless explanation is deemed desirable or necessary.*]

(Not filled out.)

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 12.—TOOLS, IMPLEMENTS, AND MACHINERY.

a. Repairs	$3.25
b. New purchases	262.98
TOTAL	266.23

NOTE—Add below items of principal purchases under *b*.

1 Corn Harvester	115.00
1 Soil Sampler	5.35
1 Harrow	18.00
1 Mower	42.00
1 Churn	51.36
Small Tools	31.27
TOTAL	$262.98

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 13.—FURNITURE AND FIXTURES.

(Not filled out.)

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 14.—SCIENTIFIC APPARATUS.

(Itemize the principal purchases; consolidate the rest.)

1 Microscope	$49.16
1 Flutriator	30.00
Thermometers	5.00
Small apparatus	43.46
TOTAL	$127.62

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 15.—LIVE STOCK

(Not filled out.)

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 16.—TRAVELING EXPENSES.

a. In supervision of Station work	$53.85
TOTAL	$53.85

NOTE—*a.* To include necessary expenses of the director or other officials in travel incident to the administration of the main station, branches, or outlying experiments.

REMARKS—The above expense was incurred in gathering samples of artesian water for analysis, and by members of the scientific staff conducting irrigation experiments 125 miles from the Station.

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 17.—CONTINGENT EXPENSES.

[*It is expected that nearly all expenditures can be classified under the accompanying schedules, and that only such items as do not properly belong elsewhere are to be entered under this account, keeping it as small as possible.*]

[State the items in detail.]	
Annual dues for membership in A. A. A. C. & E. S.	$10.00
Stallion service	12.00
TOTAL	$22 00

South Dakota Agricultural Experiment Station, 1894-5.

ABSTRACT 18.—BUILDING AND REPAIRS.

[*By the terms of the law the aggregate expenditures for Building and Repairs are limited to $750 per annum.*]

a. New buildings	
b. Improvements	
c. Repairs	$251.07
TOTAL	$251.07

NOTE.—*b.* Include under this head all improvements of buildings or land, such as plumbing, heating apparatus, gas fixtures, fencing, and drainage, not made specifically as experiments.

PRESIDENT'S REPORT.

LEWIS McLOUTH.

Attention is called to the itemized statement of expenditures published in this report according to the new regulations of the National Department of Agriculture.

During the year for which this report is made, Mr. Cyril G. Hopkins, assistant chemist, resigned to take the position of station chemist in the experiment station of Illinois. His place was filled by the appointment of Mr. Herbert B. Mathews. Mr. Henry C. Irish acted for a short time as assistant in horticulture but was soon called away by an appointment in the St. Louis botanical gardens under Dr. Trelease. His place was then filled by the appointment of Fred K. Luke, B. S., of this college.

During the year something over eight hundred dollars were used for additions to the station outfit of books, tools, machinery, and scientific apparatus.

On account of the unprecedented drouth during the summer of 1894, the experimental work of the farm and in the gardens was very much limited. In consequence of this drouth it became necessary to expend a very much larger sum than usual from the Experiment Station funds for feeding stuffs for the stock.

The ordinary meteorological observations were continued as for the past several years, and some additional meteorological work was undertaken in soil temperatures,

and to show the effect of proximity of young tree plantations upon the force and direction of winds, and upon the atmospheric moisture. Laboratory experiments were also continued in the forcing house in the department of botany and entomology, in the department of zoology and bacteriology, of animal pathology, of chemistry and of dairying.

The interest of more advanced students is showing, year by year, a marked increase in the various scientific problems in agriculture and the underlying sciences that are being studied in the Experiment Station.

During the year, four bulletins were issued by the station council, as follows: In January, 1895, the department of chemistry issued Bulletin No. 41, of 76 pages, covering a study and an analysis of the waters of the artesian wells of the state with reference to their utility for irrigation purposes. Waters from the artesian wells of the following twenty places were analyzed, to-wit: Yankton, Harrold, Miller, Huron, Iroquois, Hitchcock, Faulkton, Redfield, Doland, Northville, Ipswich, Aberdeen, Andover, Westport, Tyndall, Armour, Chamberlain, Kimball, Woonsocket, and Pierre.

In February of the same year, Bulletin No. 42 was issued by the department of horticulture and forestry, consisting of 16 pages, upon squashes, for the purpose of determining the reason why so many vines, while making satisfactory growth do not set fruit. Suggestions were also made in this bulletin upon methods of planting and of culture, and something upon the insect enemies of the squash, and the varieties recommended.

In May, 1895, the department of botany and entomology issued a 30 page Bulletin No. 43, upon native trees and shrubs. This bulletin attempted to show something

concerning the geographical distribution of trees in the state, giving a list of the trees that are found in various districts of the state and entered into a somewhat more complete discussion of the forestry condition of the state.

In June, 1895, the department of horticulture and forestry issued Bulletin No. 44, of 28 pages, upon the forestry experiments at the Station of the Agricultural College. This bulletin mentions some of the varieties which seem to thrive best in this climate and discusses their hardiness and adaptability. There is also in this bulletin a comparison meteorological table for the years 1889 to 1894 inclusive, and a corresponding table showing the growth of several of the tree plats under cultivation here in the corresponding years.

Ten thousand copies of each of these bulletins were printed and they have been mailed to the other stations and to our own state subscribers to the number of about seven thousand each.

During the next and coming years the departments of agriculture and chemistry hope by joint labor to investigate more fully the value of native grasses for hay and pasture; there will be work undertaken in dairy bacteriology, and in dairy art and science generally, while the study of economic entomology and botany will be continued.

By Professor Hansen's assistance, the following notes of the work of the horticultural and forestry department for this year are presented.

The new experiments started in the spring of 1894 were mainly variety and cultural tests with tomatoes, squashes, onions, cabbage, cucumbers and other garden vegetables. Owing to the extreme drouth of 1894, nearly all failed except the squashes. Forestry plat No. 31 was planted, mostly with elms. The drouth and late frosts prevented

a crop of fruit in the orchard. The results of the experiment with squashes were published in Bulletin No. 42, of which the following is the summary:

SUMMARY AND CONCLUSIONS.

1. The failure of squash flowers to set fruit is due to a lack of proper pollination.

2. When insects are not present in sufficient numbers to insure pollination, hand pollination may be relied upon to give a supply of fruits for home use.

3. It is safe to state that in prairie soil squash seed should never be planted less than two inches deep, and then in hills below the general level of the soil.

4. In general, the best time to plant is, between the fifth and fifteenth of May.

5. Tobacco dust mixed with the soil of the hill, and later used as a mulch is a most satisfactory preventive for squash bugs and cucumber beetles.

6. Summer Crookneck is the best early squash for this state.

7. Pike's Peak or Sibly squash has given the largest yield of fruits of good quality of any variety tested. The Boston Marrow stands second.

In the spring of 1895, variety and cultural tests were started with tomatoes, cucumbers, squashes, onions, cabbage, salsify, parsnips, carrots, sweet corn, sugar beets, peas, beans, and other garden vegetables. The results of the tests of tomatoes, onions and beans will be published in a subsequent bulletin.

A variety test of strawberries and raspberries was begun. The strawberries were a good stand, but most of the raspberry plants failed. An addition to the plum orchard was made, and about 780 grapevines planted.

Several thousand young trees of box elder, ash, hornbeam, cherry, Austrian pine and *pinus ponderosa* were added as replants to forestry plats. Some maple and elm seed was sown. The maples were a good stand, the elm mostly failed.

The forestry plats were studied and the results published June, 1895, in Bulletin No. 44, of which the following is the

SUMMARY.

1. Among valuable timber and ornamental trees which are not injured by late springs frosts, we have: Wild black cherry, white birch, white elm, Scotch pine, red cedar and cottonwood.

2. Species which are most injured by frost are: European larch, walnut, oak, and ash.

3. The age and conditions under which a tree is growing influence the injury from late frosts quite as much as the family or species to which it belongs.

4. In rate of growth all forest trees are not alike affected by precipitation, some follow closely the line of direction of the rainfall while others are quite independent of it.

5. When planted in groves a critical period in the growth of the cottonwood and box elder is reached at a time when natural pruning begins, and heavy losses are, at that time, liable to occur.

6. None of the combination of species as they exist in the plats upon the Station grounds are satisfactory in all particulars, therefore, none of them are recommended for use by the general planter.

7. Pure plantations of any one species are not advocated unless in the case of the maple when grown from seed as noted on page 148.

8. The following trees are discarded as being of uncertain value for planting in groves upon high prarie: *Poplus (certinensis) laurifolia*, cottonwood, European larch, willow (*Salix fragilis.*)

9. The following species for general planting are recommended in the order named: Deciduous—white elm, green ash, wild black cherry, burr oak, black walnut, white birch, box elder, laurel-leaved willow. Cottonwood for street or lowland groves, balm of gilead as specimen tree. Evergreens—Scotch pine, red cedar, white spruce.

10. The future timber supply of this country is a feature to be kept constantly in view in selecting trees for permanent plantations, yet the greatest value resulting from extended tree planting arises from the protective influence which they exert.

Professor Hansen has also furnished the outlines of proposed work in his department for the coming year.

OUTLINE OF PROPOSED EXPERIMENTS FOR THE DEPARTMENT OF HORTICULTURE AND FORESTRY.

NELS E. HANSEN.

1. Variety tests of the apple, cherry, plum, and other orchard fruits. New and promising varieties will be tested both in nursery and orchard, and will be propagated in a small way for trial throughout the state.

2. Variety and cultural tests of the grape, raspberry, strawberry, blackberry, currant, gooseberry and other small fruits.

3. Experiments to determine the best hardy stocks for the apple, plum, cherry, and other orchard fruits. At present, fruit growers complain of trouble from root-killing of the tender commercial stocks upon which the orchard fruits are budded or grafted. Many varieties of the

apple fail from sunscald of the stem, but do well top-grafted upon hardier varieties, such as hibernal and other hardy Russians. An extended series of experiments will be undertaken to determine the best stock for each variety.

4. Experiments to determine the value of *subsoiling* as a remedy against drouth. On application made to Deere & Co., of Moline, Ill., a new "Iron King" subsoiler plow was donated. I have long been convinced of the great value of subsoiling in increasing the drouth-resisting capacity of land. By recent experiments in Kansas and Nebraska, it appears that subsoiling is equally valuable in ordinary farm practice.

5. Variety and cultural tests of garden vegetables, including the development of an extra early tomato by crossing and continued selection; also the development of native species.

6. Experiments in increasing the hardiness and drouth-resisting capacity of cultivated varieties of grape vines by crown-grafting on wild grape vine roots. Observations in European vineyards in 1894, convince me that this is a fruitful field of investigation.

7. Variety, cultural and propagation tests of a great many kinds of ornamental trees, shrubs and plants, including the development of our wild prairie rose by hybridizing with the best cultivated varieties. Promising new varieties will be propagated and disseminated for trial throughout the state.

8. The new experimentation in forestry will chiefly be controlled by the U. S. Division of Forestry. Our independent Station work will be largely in the line of additional variety tests and to determine the best species for shelter belts; also to determine the relative hardiness of trees

grown from northern and southern seed. Prof. Chas. S. Sargent, director of the Arnold Arboretum of Harvard University, has promised to aid us in the way of obtaining trees for trial.

9. The originating of improved hardy varieties of the orchard and small fruits by crossing, hybridizing and pure seedling production. This will include the crossing of the hardiest American and Russian varieties; also the development of the wild fruits of South Dakota, such as the plum, sand cherry, grape, strawberry, raspberry, currant, gooseberry and juneberry, by crossing and hybridizing with the best cultivated varieties. All promising varieties obtained in this manner are to be propagated and sent out for trial throughout the state. Considerable work in this line has been done at the Iowa Agricultural College with good results so far, and this line of experimentation, which may be termed *fundamental* work in horticuture, is deemed of the greatest possible importance to the fruit growing interests of the state.